

Do Different Livelihood Strategies Result in Varying Barriers to Livelihood Resilience: Evidence from Danxia Mountain World Heritage Site, Guangdong

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Abstract: Rural revitalization is an important national development strategy and a necessary means to solve the “Three Rural Issues” (agriculture, rural areas, and farmers). Promoting rural revitalization in world heritage sites from the perspective of livelihood resilience is an important way to advance the modernization of socialism. This study focuses on residents from 6 villages, including Qinghutang Village, within the Danxia Mountain UNESCO World Heritage Site in Guangdong, China. By conducting field research and constructing an obstacle degree model, the study identifies and analyzes the key factors hindering livelihood resilience among local communities. The study finds that buffering capacity is the main obstacle factor affecting the livelihood resilience of residents in Danxia Mountain. Residents with different livelihood strategies share the same main livelihood resilience obstacle factors, although the ranking of these factors varies among groups. Compared with other livelihood strategy groups, for the farming group, social connectivity has a greater constraining effect on livelihood resilience than skill training opportunities. The study proposes recommendations to enhance residents’ quality of production and daily life while strengthening risk resilience against unexpected events from a micro-level perspective. The findings aim to promote sustainable development in China’s world heritage sites and their surrounding areas, thereby facilitating the steady advancement of rural revitalization nationwide.

Keywords: World heritage site; Obstacle degree model; Livelihood resilience; Rural revitalization; Danxia Mountain

Online publication: May 2, 2025

1. Introduction

Rural revitalization serves as a crucial strategy for achieving the great rejuvenation of the Chinese nation, with enhancing livelihood resilience among rural residents constituting a pivotal element in addressing the Three Rural Issues. Many rural areas in China, especially world heritage sites, are frequently threatened by natural disasters

such as floods, droughts, and landslides. Meanwhile, the prevalent mono-economic structures in these areas often render rural communities particularly vulnerable to market fluctuations. Building on theoretical explorations of social-ecological systems in addressing climate change and environmental variability, international scholars have proposed the concept of livelihood resilience to analyze the mechanisms through which residents' livelihood systems sustain and adapt to disturbances ^[1-3]. Obstacle degree analysis serves as an effective diagnostic tool and has been extensively utilized to assess and identify critical factors influencing livelihood resilience and land use ^[4-5]. In recent years, domestic scholars have conducted relevant studies across multiple case sites, revealing the influencing factors and obstacle degree characteristics of livelihood resilience among farmers or residents in different regions.

Building upon existing research frameworks, scholars, including Huang Chengkun, have conducted case studies in Yuanjiacun Village, Lishan County, Shaanxi Province, systematically examining livelihood resilience and its obstacle factors for rural households in tourist destinations under disaster disturbances. The findings indicate that key obstacle factors affecting residents' livelihood resilience include kinship-based village leadership structures, opportunity assessment capacities, livelihood diversification initiatives, income source heterogeneity, and participation in social governance mechanisms. Notably, the distinct organizational and industrial configurations characteristic of Yuanjiacun Village exert significant moderating effects on rural households' livelihood resilience patterns ^[6]. Scholars such as Wu Jilin have focused on 10 ethnic tourism villages in the Wuling Mountain Area of Hunan and Hubei. They pointed out that the education level of the core family members, the opportunities for professional skills training, the number of family members participating in tourism, and the types of relief subsidies available to families are the main obstacle factors affecting the livelihood resilience of residents in the Wuling Mountain Area. These obstacle factors show a certain degree of convergence among households with different livelihood types ^[7]. Extending this analytical paradigm, scholars, including Liu Jiale, have conducted empirical research in Pingyao Ancient City, Shanxi Province, revealing distinct configurations of obstacle factors affecting livelihood resilience across resident typologies ^[8]. Guo Leilei has taken Zhong County in Chongqing as a case study to investigate the impact of the Rural Integrated Complex construction on the livelihood resilience of rural households and the main obstacle factors affecting two towns. The study indicates that in enhancing the livelihood resilience of rural households, there are significant obstacles in social participation and learning mechanisms, but no significant differences are observed between regions ^[9].

With the academic community's sustained in-depth exploration of livelihood resilience, its conceptual framework and theoretical system have been progressively refined, yielding innovative solutions for various rural sustainable development challenges. However, insufficient attention has been devoted to identifying systematic variations in obstacle factors affecting livelihood resilience across distinct livelihood strategy groups within heritage site populations. This oversight hinders the development of targeted interventions at micro-level production and livelihood dimensions to enhance risk resilience against emergent crises, particularly given the documented influences of mechanisms like kinship-based village leadership structures and income source heterogeneity observed in prior studies.

2. Research methods

2.1. Case study sites

This study selected the Danxia Mountain World Heritage Site in Guangdong, China, as the location for field

research. Danxia Mountain, also known as China's Red Stone Park, is located at coordinates 113°36'11.347" E, 24°51'25.4" N, with a total area of 292 square kilometers, making it the largest scenic area in Guangdong Province. As the most typical, comprehensive, and morphologically diverse concentration of Danxia landforms globally, Danxia Mountain is also the namesake of the "Dania landform" classification. Since its development in 1988, it has been designated as a National Scenic and Historic Interest Area, a National AAAAA Tourist Attraction, and was among the first global geoparks recognized in 2004. In 2010, it was inscribed on the UNESCO World Heritage List. The mountain is divided into seven main scenic zones: Danxia Scenic Area, Shaoshi Scenic Area, Bazhai Scenic Area, Xianrenji Scenic Area, Jinjiang Gallery Scenic Area, and others. The Jinjiang River flows from north to south through the park, with currently 12 square kilometers open for tourism. Danxia Mountain attracts domestic and international visitors due to its unique geological formations and cultural heritage. Tourism has become a key livelihood strategy for nearby residents, particularly in villages such as Xiafu (287 households, 1,139 residents), Yaotang (44 households, 169 residents), Duanshi (49 households, 222 residents), and Qinghutang (125 households, 521 residents). The area is characterized by its vast size, complex topography, integration of geological and cultural ecosystems, and a large number of indigenous communities.

2.2. Data acquisition

To comprehensively characterize the obstacle factors of livelihood resilience for residents in the case study sites, this paper constructs an evaluation index system for the obstacle degree of livelihood resilience of residents in heritage-type tourist destinations. This is achieved by referring to previous indicators and quantitative assignments for measuring residents' livelihood capital, and combining them with the actual situation of residents in the case study sites^[9-10]. The survey questionnaire comprises two sections: socio-demographic information and livelihood resilience measurement indicators. Livelihood resilience is structured into three dimensions: buffering capacity, self-organization capability, and learning capability (**Table 1**). Based on the pre-survey, the research team revised the questionnaire to finalize it. From December 10 to 17, 2024, the team conducted a field survey in Danxia Mountain and distributed questionnaires, obtaining 228 valid responses. Based on the pre-survey, the research team revised the questionnaire to finalize it. From December 10 to 17, 2024, the team conducted field surveys in six villages of Danxia Mountain, namely Qinghutang Village, Xinma House Village, Yaotang Village, Duan Stone Village, Chewan Village, and Xiafu Village. Using a convenience sampling method, the team distributed questionnaires on-site and obtained 228 valid responses.

2.3. Research techniques

By constructing an obstacle degree diagnostic model, the main obstacle factors affecting residents' livelihood resilience were identified. After calculating the weights using the entropy method (**Table 1**), the obstacle degree model was integrated into the measurement index system of livelihood resilience, with the calculation formula as follows:

$$F_i = R_j \times W_i \quad I_i = 1 - X_i \quad O_i = \frac{F_i \times I_i}{\sum_{i=1}^{31} (F_i \times I_i)} \times 100\% \quad (1)$$

In the formula, F_i denotes the factor contribution degree, representing the extent to which the i -th indicator contributes to livelihood resilience; R_j is the weight value of the j -th indicator to which the i -th indicator is subordinate; W_i is the weight value of the i -th indicator; I_i denotes the indicator deviation degree; X_i is the extreme difference standard value of the i -th indicator; and O_i represents the obstacle degree index, quantifying the impact

of the i -th indicator on residents' livelihood resilience.

3. Identification and analysis of internal obstacle factors in residents' livelihood resilience

3.1. Analysis of obstacle factors in livelihood resilience

From the perspective of the criterion layer (**Table 1**), the obstacle factors affecting the improvement of residents' livelihood resilience in Danxia Mountain, in descending order, are buffering capacity, learning capability, and self-organization capability. From the perspective of the indicator layer, the top three obstacle factors with the highest obstacle degrees are water resources, forest resources, and social connectivity (**Table 1**).

Table 1. Indicator weights and obstacle degree estimation of residents' livelihood resilience in Danxia Mountain

Livelihood resilience of residents	Criterion layer weights (r)	Criterion layer obstacle degree (%)	Measurement indicators (Z)	Indicator layer weights (w)	Indicator layer obstacle degree (%)
Buffering capacity	0.8	82.43	Arable Land Resources (Z_1)	0.07	6.24
			Water Resources (Z_2)	0.12	12.02
			Forest Resources (Z_3)	0.11	10.88
			Skill Training Opportunities (Z_4)	0.11	8.35
			Social Connectivity (Z_5)	0.11	8.43
			Social Support (Z_6)	0.09	7.79
			Location Advantage (Z_7)	0	0.06
			Social Welfare (Z_8)	0.01	1.05
			Family Housing Situation (Z_9)	0	0.16
			Family Fixed Assets (Z_{10})	0	0.24
			Tourism Business Floor Area (Z_{11})	0.06	5.4
			Tourism Business Fixed Assets (Z_{12})	0.03	0.87
			Credit Opportunities (Z_{13})	0.01	0.96
			Income Diversity (Z_{14})	0.04	3.22
			Family Annual Income (Z_{15})	0.05	3.79
			Cultural Awareness (Z_{16})	0.02	0.85
			Cultural Application (Z_{17})	0.04	2.93
			Cultural Ownership (Z_{18})	0.08	6.75
			Family Size (Z_{19})	0.01	0.98
			Family Labor Capacity (Z_{20})	0.01	0.46
			Family Health Status (Z_{21})	0	0.05
			Family Education Level (Z_{22})	0.01	0.97

Table 1 (Continued)

Livelihood resilience of residents	Criterion layer weights (r)	Criterion layer obstacle degree (%)	Measurement indicators (Z)	Indicator layer weights (w)	Indicator layer obstacle degree (%)
Self-organization capability	0.09	6.64	Neighborhood Trust (Z_{23})	0.05	0.13
			Village Organization Satisfaction (Z_{24})	0.06	0.24
			Policy Understanding (Z_{25})	0.25	1.67
			Social Network (Z_{26})	0.52	3.91
			Policy Satisfaction (Z_{27})	0.12	0.68
Learning capability	0.11	10.93	Crisis Adaptation Ability (Z_{28})	0.13	1.27
			Learning and Implementation Ability (Z_{29})	0.16	1.23
			Information Attention Level (Z_{30})	0.13	1.1
			Practical Exploration (Z_{31})	0.59	7.34

3.2. Comparative analysis of obstacle factors among different livelihood strategy groups

Taking the 228 resident households in the Danxia Mountain tourism heritage site as the research objects, they were categorized into four groups based on their livelihood strategies: tourism-based livelihoods, tourism-combined livelihoods, farming, and wage labor. A comparative analysis was conducted to examine the similarities and differences in the main obstacle factors affecting livelihood resilience among these different livelihood strategy groups (Table 2).

Table 2. Analysis of differences in livelihood resilience obstacle factors among different livelihood strategy groups

Tourism-based livelihoods		Tourism-combined livelihoods		Farming-based		Wage-labor	
Obstacle factors	Obstacle degree	Obstacle factors	Obstacle degree	Obstacle factors	Obstacle degree	Obstacle factors	Obstacle degree
Z_2	12.22	Z_2	12.03	Z_2	11.29	Z_2	12.23
Z_3	11.03	Z_3	11.12	Z_3	9.86	Z_3	11.26
Z_4	8.51	Z_4	8.14	Z_5	9.57	Z_4	8.18
Z_5	8.48	Z_6	7.99	Z_4	8.35	Z_5	7.92
Z_6	7.84	Z_5	7.65	Z_6	7.39	Z_6	7.88

The top five indicators with the highest obstacle degrees are identified as the main obstacle factors for livelihood resilience. For the tourism-based livelihood strategy group, the ranking of the main obstacle factors for livelihood resilience is as $Z_2 > Z_3 > Z_4 > Z_5 > Z_6$; the ranking of major obstacle factors to livelihood resilience in tourism-combined livelihood strategy Groups is as $Z_2 > Z_3 > Z_4 > Z_6 > Z_5$; the ranking of the main obstacle factors for livelihood resilience in the farming-based livelihood strategy group is as $Z_2 > Z_3 > Z_5 > Z_4 > Z_6$; the ranking of the main obstacle factors for livelihood resilience in the wage-labor based livelihood strategy group is as $Z_2 > Z_3 > Z_4 > Z_5 > Z_6$. The primary obstacle factors to livelihood resilience are identical across tourism-based, tourism-combined livelihoods, farming-based, and wage-labor livelihood strategy groups, comprising water resources,

forest resources, skill training opportunities, social connectivity, and social support level (**Table 2**). Notably, water and forest resources consistently rank as the top two obstacles. For the tourism-based, tourism-combined, and wage-labor livelihood strategy groups, skill training opportunities have a greater impact on livelihood resilience compared to social connectivity and social support. However, for the farming group, social connectivity has a greater impact on livelihood resilience than skill training opportunities.

4 Conclusions and discussion

4.1. Conclusions

At the criterion layer level, buffering capacity constitutes the primary obstacle. The major obstacle factors are broadly consistent across different livelihood strategy groups, comprising water resources, forest resources, skill training opportunities, social connectivity, and social support level. However, their rankings vary slightly. Notably, water resources and forest resources consistently rank as the top two primary obstacle factors to livelihood resilience across all groups. For the group whose livelihood strategy is farming, social connectivity exerts a greater constraining effect on enhancing livelihood resilience than skill training opportunities. For other livelihood strategy groups, skill training opportunities pose a more significant constraint on improving livelihood resilience.

4.2. Discussion

To precisely address the obstacle factors affecting livelihood resilience among residents in Danxia Mountain, targeted measures should be implemented based on challenges at different dimensions. From the perspective of the criterion layer, buffering capacity is the main obstacle. Therefore, it is necessary to enhance residents' buffering capacity by optimizing resource utilization and strengthening infrastructure construction, thereby improving their ability to cope with risks. From the perspective of the indicator layer, water resources, forest resources, and social connectivity are the key obstacle factors. On the premise of resource protection, the utilization of natural resources can be planned rationally to develop eco-tourism and characteristic agriculture. Meanwhile, strengthening residents' social connectivity and providing skill training and social support can enhance their social capital and ability to deal with crises. To address the needs of different livelihood strategy groups, differentiated strategies should be formulated. For farming-based groups, measures such as organizing agricultural information exchange activities, providing venues for communication and leisure (e.g., agricultural product trade fairs), and establishing e-commerce platforms can enhance their social connectivity. For wage labor groups (e.g., migrant workers), diversified vocational skill training courses tailored to market demands and group characteristics, along with personalized training programs, should be developed to strengthen skill training capacity.

Funding

This work was funded by the National Natural Science Foundation of China [42171242] and Guangdong Provincial Philosophy and Social Sciences Planning Project [GD23CSH01]

Disclosure statement

The authors declare no conflict of interest.

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